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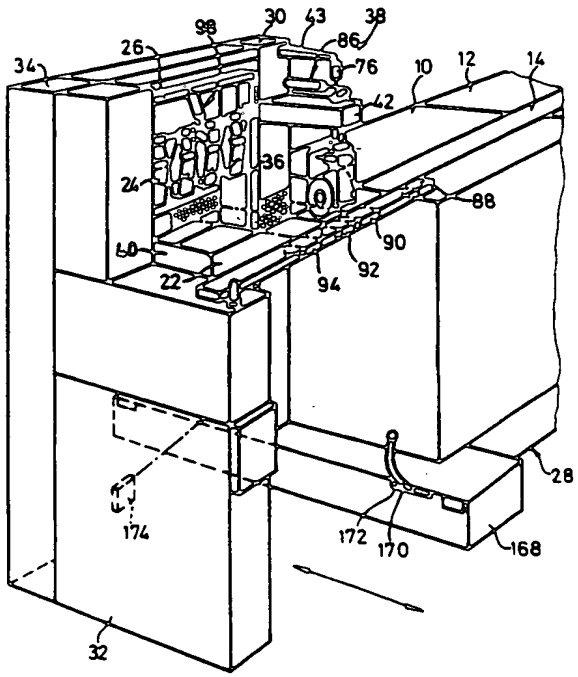
(54) Handling of thread packages with an oriented configuration.

(57) In a handling system for handling conical thread packages delivered on a conveyor (14), a device (38) is provided to sense the orientation of each package, to compare it with a desired orientation, and to reorient the package if required before relasing the package to a further conveyor (22) on which groups of oriented packages are formed.

Fig.1



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HANDLING OF THREAD PACKAGES WITH AN ORIENTED CONFIGURATION

The present invention relates to a system for handling thread packages with an oriented configuration especially conical thread packages (or 'cones') such as those produced by spinning machines (e.g. rotor spinning machines) or winding machines, an apparatus for orienting and a device for removing such thread packages.

Prior art

In FR-A-2 250 699 an equipment for handling spinning cops is described in order to arrange the same sense of orientation of the tubes on a vertical conveyor. In dependency of this orientation the cops will be thrown out with a clockwise or counterclockwise rotation, which is caused by a mechanical lever system. The sence of orientation of the spinning cops is therefore always the same and cannot be changed.

A bobbin lifting and orienting mechanism has been described in US-A-3 853 215. The bobbins are grasped by a gripper whereas a guide prevents lifting of the butt ends of the bobbins and thus urging the bobbin gripper to pivot. The bobbins are then further conveyed in a vertical direction with the apical end up. Also with this mechanism, which is handled purely mechanical, the sense of orientation cannot be changed.

In our previous patent application EP-A-099 959 there is described and claimed an apparatus for arranging cross-wound thread packages. That application is concerned in particular with the control of conveyor belt arrangements upon which the thread packages are conveyed; the control system enables accumulation of a group of packages in a predetermined array while avoiding disturbance in the outer layers of the accumulated packages commonly caused by relative movement between a package and a conveyor belt on which the package rests. The full disclosure of that prior application is incorporated in the present specification by reference.

Although the invention in the prior application is not limited to use with cylindrical packages ('cheeses') the embodiments actually illustrated in the prior application were all designed for handling such packages. The present specification will describe developments particularly designed to enable modification of the system disclosed in the prior application for use with conical packages.

Present Invention

In a first aspect, the invention provides a handling system for thread packages comprising a main transport conveyor and at least one auxiliary transport conveyor forming an extension of the main conveyor. The auxiliary conveyor is operable as an accumulator to group packages transferred to it from the main conveyor. Removal means can be provided to remove a group of packages from the auxiliary conveyor so that the conveyor can receive further packages from the main conveyor.

The removal means may be adapted to move the group of packages to a predetermined location at which they can be transferred to a suitable receiver therefor when the latter is brought into operative relationship with the removal means. Means is provided at the junction of the main and auxiliary conveyors to sense orientation of a conical package arriving at the junction and to change the package orientation if required to ensure that each package in a group on the auxiliary conveyor has a predetermined orientation.

Each group formed on the auxiliary conveyor preferably comprises a predetermined number of packages arranged in a row. In principle, the system could be operated so that the individual packages of a given group have respective different orientations. Preferably, however, the system is operated so that all packages in a given group have the same orientation. The predetermined orientation is nevertheless preferably selectable so that successive groups can be arranged to have respective different orientations.

The means for sensing and changing package orientation is preferably arranged to respond to and act on a package on the auxiliary conveyor in a region thereof adjacent the main transport conveyor.

The handling system may further comprise means for controlling movement of a package receiver relative to the remover means. For example, the system may comprise a selectively operable moving means and a releasable connecting device for selectively coupling the moving means with a package receiver.

Control and monitoring means may be included so that the system responds automatically to predetermined events in order to fill a package receiver in an ordered and controlled manner with packages arriving at the handling system in an order which is outside the control of the handling system.

In a second aspect the invention relates to an orienting device for thread packages with an oriented configuration, especially thread packages. In this specification the word 'conical' is to be con-

strued as including 'frusto-conical'.

The orienting device comprises at least two package engaging elements adapted for relative movement to form an openable and closable package gripper, and means to rotate the gripper about an axis transverse to the opening and closing movements of the elements. At least one element comprises a part mounted for movement between a first and second disposition relative to the gripper, the part being in a first disposition when the gripper closes on a thread package oriented in one direction and in the second disposition when the gripper closes on a thread package oriented in the opposite direction. Sensor means is provided to sense the disposition of the movable part.

The gripper may comprise a carrier and the first and second elements may be pivotally mounted on the carrier to enable opening and closing of the gripper. The carrier may be rotatable to enable rotation of the gripper about an axis transverse to the opening and closing movements thereof.

Preferably, the gripper is movable linearly along the rotation axis between first and second positions to enable raising of thread package held in the gripper prior to rotation thereof and lowering of the thread package after rotation thereof.

The movable part may be pivotable about a second axis transverse to the opening and closing movements of the gripper.

In a third aspect of the invention is provided a package removal means for removing a package from a support or conveyor on which the package rests. The removal means comprises an openable and closeable package gripper and means for raising and lowering the gripper along a path to one side of the support. A pivot mounting enables pivoting of the gripper relative to the raising and lowering means. Pivoting means is operable to cause pivoting of the gripper on the mounting to engage a package on the support or conveyor from below and to one side to enable the gripper to grasp the package for lifting clear of the support.

The pivoting means may include abutment means engageable by the gripper during downward movement along said path so that upon continued downward movement the gripper is guided under a package on the support or conveyor by the abutment means.

By way of example, an embodiment of the invention will now be described with reference to the accompanying diagrammatic drawings, in which:

Figur 1 is a perspective view of an end section of a textile machine fitted with a package handling system according to the invention,

Figur 2 is a plan view of part of a textile machine with which the package handling system can be used, the view showing the end of the machine spaced from the package handling system,

Fig. 3 is a front elevation of a package orienting device according to the invention,

Fig. is a side view of a part of the device shown in Fig. 3,

Fig. 5 is a section taken on the line V-V in Fig. 4,

Fig. 6 shows a flow chart of one form of control operation for a device as shown in Figs. 3 to 5,

Fig. 7 shows a diagrams for unse in explanation of Fig. 6,

Fig. 8 shows a sectioned side elevation of one end part of a package receiver with packages deposited therein, and

Fig. 9 shows a series of diagrams representing movements of a package removal means.

In Fig. 1, reference numeral 10 indicates in block diagrammatic form an end unit of an elongate textile machine, part of the main body of which is indicated in equally diagrammatic form at 12. Details of the textile machine itself are not important to the present invention, and have been omitted. The machine could, e.g., be a spinning machine, e.g. a rotor spinning machine of the type shown in US Patent no. 3511045. Alternatively the machine could be back winding machine, e.g. of the type shown in the US Patent no. 4154411. Still further the machine could be a false twist texturizing machine, e.g. as shown in US Patent specification no. 3811631.

Machine configuration

Only three features of the machine are of significance in relation to this invention, namely

- 1) a conveyor belt 14 is provided extending along the length of the machine to carry thread packages to the illustrated end of the machine,
- 2) the machine is of a type producing conical (that is frusto-conical) thread packages, and
- 3) the arrangement is such that thread packages are deposited on belt 14 sometimes with their narrow ends 'forward' (considered in the conveying direction) and sometimes with their broad ends 'forward'.

By way of example only, Fig. 2 shows an arrangement which would produce the above features. The plan diagram in Fig. 2 shows the opposite end of the machine from that illustrated in Fig. 1. The machine is of the double-sided type with a large number of independently operable, thread processing stations arranged in two rows on opposite machine sides. Each processing station includes its own package-forming section forming conical packages 16. When a package at one of the processing stations is 'full' it is transferred to

the belt 14 und transported thereby to the machine end shown in Fig. 1.

Transfer of a full package from the processing station to the conveyor 14 is effected by a travelling doffer 18 movable on a U-shaped rail 20 into alignment with any selected one of the processing stations.

During formation, the longitudinal package axis is disposed parallel to the length of the machine, and hence to the length of belt 14. For convenience in design of the doffer 18, however, the processing stations on one machine side are arranged so that their packages 16 are formed with smaller ends pointing towards the right as seen in Fig. 2, and the processing stations on the other machine side are so arranged that their packages are formed with the smaller end pointing towards the left as viewed in Fig. 2. Furthermore, in order to avoid complication in design of the doffer, the orientation of a package 16 is not changed during transfer between the processing station and the belt 14.Finally, the machine operates on the 'random' doffing principle so that processing stations are not doffed in a predetermined sequence. Accordingly, the package handling system shown in Fig. 1 has no effective control over the orientation of an 'incoming' package; that package may be oriented with either its narrow end or its broad end facing longitudinally of the belt 14 towards the machine end shown in Figure 1.

Handling System Configuration

The handling system itself is similar to that disclosed and claimed in EP-A-0099959. For the sake of completeness of the present description, a brief outline of that system will be repeated here, but full details can be obtained from the prior application.

The handling system comprises an auxiliary conveyor belt 22, longitudinally aligned with and forming an extension of the belt 14. Belt 22 is selectively operable by means of a control system, described in detail below, in order to line-up four thread packages in a row with a predetermined spacing between the packages. When so arranged, the four packages can removed simultaneously by a removal means comprising four package grabs 24. Grabs 24 are adapted to close around respective thread packages grouped on the belt 22, and they are carried by a common frame member 26 so that they are movable simultaneously to lift the packages from belt 22 and to move them to one side thereof.

The prior application describes a control system for controlling operation of the belt 22. This control system enables operation of belt 22 for only a short period following arrival of an incoming package thereon so as to move that package through approx. one bobbin length away from the junction of the main and auxiliary belts. This enables a row of packages to be formed with a predetermined spacing between the adjacent packages but without rubbing between belt 22 and the outer windings on the packages supported thereby. Full details of that control system can be obtained from the prior application. Modifications enabling its use in the present invention will be described later in the present specification. Alternative control systems for use with the present invention will be described with reference to the drawings.

As is apparent from Fig. 1 conveyor belt 14 of the machine is located well above ground level indicated at 28. Belt 22 forms a horizontal extension of belt 14, and for this purpose is supported by a bridge structure comprising a support pier 32 spaced from the end unit 10 of the machine and a bridging frame (not illustrated) extending between end unit 10 and support pier 32.. The bridging frame carries belt 22. A package-receiving carriage, can be moved in directions indicated by the double headed arrow in Fig. 1 between the pier 32 and the machine end unit 10. As will be described, packages removed from belt 22 are to be layed in an ordered fashion in a receiver carriage controllably located in relation to the bridge structure.

The bridge structure further comprises two columns 30, 34 respectively, column 30 being associated with machine end unit 10 and column 34 being associated with pier 32. Columns 30 and 34 are located to one side of the bridging frame carrying belt 22, and the columns support between them the frame 26 referred to above. In their surfaces facing toward each other, each column has a vertical slot, only slot 36 in column 30 being visible in the figure. Frame 26 is movable along these slots by moving means within the columns between upper and lower limit positions, being illustated in its upper limit position in Fig. 1. The slots extend suffiently far down columns 30 and 34 to enable lowering of grabs 24 into the interior of a package-receiving carriage suitably located relative to the bridge structure.

Lay-Down Pattern

In order to obtain efficient utilization of each package-receiving carriage, it is desired to lay the packages therein in a specific, ordered pattern which will now be described. The packages are to be arranged in horizontally disposed layers, each layer comprising a plurality of parallel rows of packages. The exact number of rows in each layer depends upon the acceptable dimensions of the

carriage and can be selected in accordance with the requirements of the machine user. There are preferably four packages in each row, corresponding with the capacity of belt 22 and the corresponding number of grabs 24.

Each row of an upper layer of packages rests on two adjacent rows of the layer beneath. The ends of the packages in the upper layers are substantially axially aligned with the ends of the packages below them, so that four 'walls' of packages are built-up, each 'wall' extending longitudinally of the carriage and transverse to the rows. Figure 8 shows part of two layers of one such 'wall', the carriage end wall and floor being indicated at 35 and 37 respectively. The floor has partitions 39 to space the rows of the lowermost layer.

All packages in any given layer have the same orientation, that is all conical packages in the layer converge in the same direction. However, the packages of a adjacent layers have opposite orientations. Thus, the broad end of a package in an upper layer rests on the narrow ends of two packages in the layer below it und supports the narrow ends of two packages in the layer (if any) above it. Consider now the implications of this required pattern for the handling system shown in Fig. 1. As already described, the 'incoming' packages arriving at the handling system on belt 14 have a 'random' orientation at least as far as the handling system is concerned. These randomly oriented packages have to be ordered for laying in the carriage in the pattern described above.

Orienting System

In accordance with the invention, a package orientation sensing and changing device 38 is provided at the junction of the main and auxiliary belts 14, 22. In the embodiment illustrated in Fig. 1, the upper run of belt 22 can be considered as divided into an 'accumulator zone' and a 'sensing zone'. The accumulator zone is long enough to permit formation of a row of Tour packages in alignment with respective grabs 24. The down stream end of this zone is defined by an upstanding stop 40 at the end of belt 22 remote from belt 14. The sensing zone is located between the accumulator zone and end unit 10, in alignment with column 30. The device 38 is associated with this sensing zone, being supported by frame elements 42, 43 secured to the column 30.

As will be described in detail, the arrival of an incoming package in the sensing zone is detected and device 38 is operated initially to sense the orientation of the newly arrived package. The sensed orientation is compared with a 'desired orientation' determined by the control system. If the actual orientation is the same as the desired orientation, then belt 22 is operated to move the package from the sensing zone to the accumulator zone. If the actual orientation is the reverse of the desired orientation then device 38 is further operated in order to lift the newly arrived package slightly away from the belt 22 and rotate it through 180 degrees into the desired orientation. The package is then lowered back onto the belt 22, which is then operated to move the re-oriented package into the accumulator zone. The 'desired orientation' is selectively variable in accordance with a predetermined program in order to produce the lay-down pattern described above.

Orienter Unit

The mechanical construction of device 38 will now be described with reference to Fig. 3 to 5. The device comprises a carrier member 44 and a pair of package engaging arms 46, 48 respectively. Each arm 46, 48 is connected to carrier 44 by a respective pivot mounting 50 enabeling pivotal movement of the arm about an axis parallel to the length of belt 22 and thus substantially parallel to the longitudinal axis of a package 54 newly arrived in the sensing zone. Arms 46, 48 are joined by a double acting piston and cylinder unit 56 selectively operable to move the lower ends of the arms towards and away from each other pivoting of the arms about their mountings 50.

Arm 46 is formed in one piece and extends downwardly from its pivot mounting 50 and is slightly curved, so that when the arms are moved towards one another by unit 56 the lowermost portion of arm 46 can make contact with 'underside' of the package 54 i.e. the side facing belt 22. Arm 48 is of similar overall length to arm 46 and extends in a similar manner away from its respective pivot mounting 50. However, arm 48 is divided into an upper portion 58 connected to the pivot mounting 50 and a lower, curved package-engaging portion 60 pivotally mounted on portion 58 by a pivot mounting 62. The pivot axis defined by pivot mounting 62 extends parallel to the plane of the upper arm portion 58 and at right angles to the pivot axis of the mounting 50. Arm portion 60 is free to pivot on mounting 62 relative to arm portion 58 between a first position in which edges 59 and 61 contact each other (Fig. 5) and a second position in which edges 52, 53 contact each other. Portion 60 will be forced into its first position when the arms close on a package oriented as shown in Fig. 3, that is with the smaller package end located adjacent edges 52, 53. Arm portion 60 will be forced into its second position relative to portion 58

when the arms close upon an package with the reverse orientation relative to unit 38.

Package Orientation Sensor

Means is provided to sense whether portion 60 is in its first or its second position relative to portion 58. As illustrated, this means comprises proximity sensor 64 fixedly mounted on the outwardly facing surface of arm portion 58. The position sensing means further comprises an indicator element 66 (Fig. 5) secured to arm portion 60 by means of a rod 68 extendable through a suitable opening 70 (Fig. 4) in the arm portion 58. When arm portion 60 is in its first position, indicator element 66 is spaced from proximity sensor 64 which reacts to absence of the indicator in its neighbourhood to indicate the first position. When arm position 60 is in its second position, indicator element 66 is moved under proximity sensor 64, which reacts to the presence of the indicator to register the second position. Proximity sensor 64 generates suitable output signals which are fed to the control system to be described further below.

Package Rotation

Carrier 44 is fixedly secured to a shaft 72 rotatably guided in support 42 referred to above. Shaft 72 is secured to a rod 74 connected to a piston (not shown) of a piston and cylinder unit, the cylinder of which is shown at 76. Cylinder 76 is secured to an arm 43 which is fixedly mounted on the column 30 above support 42 (see Fig. 1). A coupling 80 (Fig. 3) is provided between connecting rod 74 and shaft 72. Coupling is such that shaft 72 is vertically movable in accordance with movements of the non illustrated piston longitudinally of the cylinder 76, but the shaft is free to rotate relative to rod 74 about a vertical axis extending longitudinally of both of them.

Rotation of shaft 74 on its coupling 80 can be effected by means of gear wheel 82 secured to shaft 72 above support 42, and a gear segment 84 meshing with the gear wheel 82. Segment 84 is mounted (by means not shown) on the support 42 for pivotal movement about an axis parallel to the axis of shaft 72. This pivotal movement of segment 84 is effected by a selectively pressurizable piston and cylinder unit 86 (Fig. 1) secured at one end to column 30 and at the other end to the gear segment. The gear ratio between segment 84 and gear wheel 82 is such that one stroke of piston and cylinder unit 86 corresponds to 180 degrees of revolution of shaft 72 about its longitudinal axis.

Orientation Operation

The operation of the device 38 is as follows:
- the device is normally maintained in 'open' condition as shown in Fig. 3 in which the arms 46, 48 are spread sufficiently far apart by the piston and cylinder unit 56 to enable an incoming package 54 to pass without difficulty into the sensing zone which lies between the arms of the device. As soon as the package is located in the sensing zone, between the arms, belt 22 is stopped and piston and cylinder unit 56 is actuated to 'close' the arms until they engage package 54 firmly on respective, opposite sides thereof (this is the condition illustrated in Fig. 1). In this condition, arm portion 60 will have been forced into its first or its second position relative to portion 58 depending upon the orientation of the package 54. The control system now carries out an interrogation operation (described later) to determine the orientation of. the package relative to the machine. The control system checks the result of the interrogation against the currently programmed desired orientation for the package 54. If the check indicates that package 54 is in the desired orientation, then unit 56 is re-actuated to open arms 46, 48 and belt 22 is re-started to move the package from the sensing zone into the accumulator zone. If the check indicates that the package is reversed relative to the desired orientation, than a package reversal operation is carried out as will now be described.

The first step in the package reversal operation is pressurization of cylinder 76 so as to lift shaft 72 and carrier 44 slightly. Arms 46 and 48 are closed on package 54 with a pressure sufficient to ensure that the package is lifted with the arms, clear of belt 22. Unit 86 is now operated so that the piston travels through one full stroke thereof and thus rotates shaft 72 through 180 degrees so that the orientation of the package carried by arms 46, 48 is reversed.
Cylinder 76 is now depressurized so that package sll is returned to the belt 22, unit 56 is actuated to open the arms 46, 48 and belt 22 is operated to move the re-oriented package into the accumulator zone.

Unit 38 is immediately ready for the arrival of the next package that is, it is not necessary to rotate arms 46, 48 back to a preset 'starting position' although the system could be designed to operate in that way. It will be appreciated that in principle each arm 46 and 48 could have a portion adjustable to the conicity of the packages being handled. It is preferred, however, to force one arm only (arm 48 in the illustrated embodiment) to undertake all of the adjustment to the package conicity; this facilitates production of an unambignous signal by the proximity sensor 64. It is not

necessary to force arm portion to any particular 'starting' position relative to portion 58. The only significant position of portion 60 for any particular sensing operation is its position after the arms have closed on the package 54.

Control System - Detector Array

The control system operates in response to an array of four detector 88, 90, 92 and gll respectively (Fig. 1). These detectors are mounted to one side of the transport path defined by the belts 14 and 22, and each is designed to respond to the presence of a package on the transport path in its immediate neighbourhood. As illustrated, these detectors are of the light barrier type, that is each is designed to emit a beam of light which, in the absence of a thread package in the detecting zone of the detector, passes across the transport path to a reflector arranged opposite the detector and is reflected thereby back to the detector. The detector responds to interruption of this light barrier by passage of an interrupting object (a thread package) between the detector and its reflector. The beams for detectors 90, 92 and 94 respectively are indicated in dot-line in Fig. 1 and the respective reflectors are indicated by cross hatching. The reflector for detector 88 cannot be seen in Fig. 1. The beam of detector 88 is directed across the end of belt 14.

Detector 88 corresponds with detector 23 in Fig. 1 of EP-A-0099959 or detector 35 in Figs. 2 and 3 of that same application, in that detector 88 responds to arrival of a package at the junction of belts 14 and 22 to cause start-up of previously stationary belt 22. The incoming package is therefore moved away from the junction into the sensing zone, where its arrival is detected by detector 90. The control system responds to detection of a package by detector 90 to carry out an orientation sensing operation and, if necessary, an orientation changing operation as described above.

The control system will prevent re-start of belt 22 by detector 88 until an already running orientation operation has been completed and the sensing zone has been cleared ready to receive the next package.

Control System - Package Accumulation

The operation of device 38 is carried out in accordance with a programmed sequence which will be described later with reference to Fig. 6. After completion of this sequence, the newly oriented package is immediately moved out of the sensing zone which is therefore free to receive a second package. The latter may already lie waiting at detector 88 or may arrive only after a delay - this is beyond the cont rol of the package handling system. When the second package enters the sensing zone, operation of device 38 is repeated and then belt 22 is again started in order to clear the sensing zone ready to receive a third package. In the course of these movements of belt 22 the first package will reach stop 40 and be held thereby in alignment with the downstream grab 24.

In the course of movement of a fourth package into the sensing zone, the second package will be brought into engagement with the first and will lie in alignment with the second last grab 24 The control system includes a counter (not shown) responsive to detection of four successive packages by detector 88 in order to prevent transfer of any further packages to belt 22 until the now-accumulated group of four packages is removed.

Thus, after completion of operation of device 38 upon the fourth package, belt 22 is restarted in order to close the third package against the second and the fourth package against the third, each package now being in alignment with its respective grab 24.

Control System - Package Removal

The control system now interrogates the outputs of detectors 92 and 94. Although not apparent from Fig. 1 due to perspective distortion, the beam of detector 94 is aligned with the upstream grab 24 and responds to the presence of the fourth package in alignment with that grab. The beam of detector 92 is directed to pass between the fourth package and the column 30. If a reflected light beam is received by the detector 92 at this stage therefore, the' signal from this detector indicates that the four packages have been accumulated correctly and that a fifth package has not penetrated the system by mistake and come to rest near the fourth package. The correct combination of output signals of detectors 92 and 94 triggers operaion of the removal means for shifting the accumulated packages off belt 22.

Package Removal System

The operation of the grabs 24 in order to grasp their respective packages on belt 22 can be seen from the sequence of diagrams in Fig. 9. It will be understood, however, that this represents only a preferred embodiment of the removal means, and that the principles of orientation of the packages can be used with removal systems other than that shown in Fig. 9.

Fig. 9a shows in diagrammatic side elevation one grab 24 from Fig. 1. Each grab is suspended from a rod 96 (also seen in Fig. 1). Rod 96 is fixedly mounted in frame 26 parallel to the length of belt 22. Each grab is rotatable about the longitudinal axis. of rod 96. A selectively pressurizable piston and cylinder unit 98 (Fig. 1) is provided to rotate the grabs together about rod 96.
Unit 98. extends between and is secured to the frame 26 and a lever 100 (Fig. 9) rotatable on and extending radially outwardly from rod 96. Lever 100 has an extension 101 (Fig. 9) carrying a bar 103 extending parallel to belt 22 past all four crabs 24 (not visible in Fig. 1).

Each grab comprises a pair of legs 102, 104 respectively mounted on and extending away from rod 96. Each leg comprises a fixing part secured to rod 96 for rotation thereon about the axis of the rod. Each leg further comprises an intermediate part rigidly secured to its fixing part via fixing plates 106. Each leg further comprises a package engaging part secured to its intermediate part by way of a respective pivot mounting 108 the function and operation of which is essentially the same as that of the pivot mounting 62 shown in Fig. 4. Finally, a selectively pressurizable piston and cylinder unit 110 extends between the plates 106 and functions in the same way as the piston and cylinder unit 56 shown in Fig. 3, that is to open and close the grab. For simplicity of illustration, the details of these leg structure have been omitted from the diagramms in Fig. 9b and 9c.

Fig. 9a shows the removal system in its starting position with frame 26 raised to the upper limit position and with piston and cylinder unit 98 fully extended so that bar 103 leaves each grab 24 free to pivot under its own weight to a substantially 'vertical' disposition as also illustrated in Fig. 1. Fig. 9c also shows a package 112 which has been aligned with the illustrated grab 24 as previously described with reference to Figs. 1 to 5. Package 112 is illustrated with its smaller end facing stop 40, but this is unimportant to the operation of the removal system, because the pivot mountings 108 (Fig. 9a) permit each grab 24 to adjust automatically to the package orientation set by the control system.

When the control system issues a starting signal, following receipt of a correct combination of signals from detectors 92 and 93 as described above, a frame drive system (not shown) in column 34 is operated to move frame 26 downwardly relative to columns 30 and 34 thus carrying rod 96 down to the position shown in Fig. 9b. During this movement, the cylinder of unit 98 (Fig. 1) is pressurized to retract the connecting rod of that unit, and thus to rotate bar 103 about the axis of rod 96 as viewed in Figs. 1 and 9. Bar 103 engages legs 102 and carries the grabs 24 with it around rod 96, but this rotational movement is limited so that the free end of each leg 102 remains to the left (as viewed in Fig. 9) of an imaginary plane indicated at 114. This plane represents the closest possible approach of any point on the outer envelope of package 112 to the path of movement 116 of the axis of rod 96.

The above desired movements are complete before grab 24 has moved down to the level of package 112. Rod 96 continues to move downwardly after the grabs have reached the disposition shown in Fig. 9b. The free end of leg 102 thus moves past the package and engages guide plate 113 projecting from the framework supporting belt 22. As downward movement of rod 96 continues, the end of leg 102 is guided by plate 113 into the converging space between package 112 and belt 22 (see Fig. 9c). When leg 102 has been inserted into this converging space to the desired extent, the movement of rod 96 along its path 116 is stopped, and unit 110 (Fig. 9a) is operated to close the legs 102, 104 on the package 112. A positioning sensor (not shown) can be used to cause stopping of rod 96 and closing of grab 24 at a fixed position of rod 96 along its path 116.

When the package 112 is firmly grasped rod 96 is raised once more and grab 24 is allowed to pivot back to its substantially 'vertical' disposition. In the course of this movement the package 112 is first lifted clear of belt 22, and than carried to one side thereof by the pivotal movement of the grab 24. Frame 24 can than be lowered in order to carry the complete group of four grasped packages into the receiver carriage waiting underneath the bridge structure.

Control System - Package Orientation

As already described above, each row of four packages accumulated on belt 22 is to be formed with the packages oriented in the same direction and for this purpose unit 38 has to carry out on each package a predetermined sequence of operations. This sequence is represented by the flow chart shown in Fig. 6. The sequence shown in Fig. 6 is triggered by a signal from detector 90 indicating the arrival of a package in the sensing zone. The control system then issues a command to stop the belt 22, this operation being represented by the block 118 in Fig. 6.

When this operation is correctly completed, the control system issues a further command to close the arms 46, 48, this operation being represented by the block 120. The control system now directs further operations into one of two routines represented respectively by the branches 124 and 126

leaving the block 122. Block 122 represents a decision by the control system whether the currently forming row of packages is to be made up with the packages in the '0' orientation (route 124) or the '180' orientation (route 126). In order to explain these latter expressions, and the background to the decision processes represented by the two branches in Fig. 6, reference will now be made to Fig. 7 which shows again in still more diagrammatic form certain of the mechanical elements referred to above.

The arrow 128 on the left hand side of the Fig. 7 represents the longitudinal direction of the belts 14, 22 with the arrow head pointing towards the stop 40 (Fig. 1). The package orientation represented at 130 near the arrow head, that is with the smaller package end facing towards the stop 40, is designated the '0' orientation'. The package orientation 132 shown near the foot of the arrow, that is with the broader package end facing towards the stop 40, is designated as the '180 orientation'. The designations are purely arbitrary, for the purpose of description only, and have no significance in relation to the invention.

The upper diagram Fig. 7a shows diagrammatically two possible arrangements of the arms 46, 48 and the piston and cylinder unit 86. In both arrangements, unit 86 is fully extended as indicated on the right hand side of the diagram. Assume, for purposes of illustration, that the indicating element 66 (and of course the proximity sensor 64, not shown in Fig. 7) is located at the 'front' of the unit 38, that is closer to the stop 40. As already described, arm 46 is maintained in a fixed orientation during sensing of orientation of the package; in Fig. 7a this arm is assumed to lie parallel to the belt direction 128. Arm 48 can, however, adopt one of two possible orientations depending upon the orientation of the package being sensed. In one arrangement shown in full lines in Fig. 7a, the 'front' end of arm 48 is closer to arm 46, corresponding to the '0' orientation of a sensed package. In the second arrangement, illustrated in dotted lines in Fig. 7a, the 'rear' end of arm 48 is closer to arm 46, corresponding to the '180' orientation of a sensed package.

Fig.7b illustrates two further possible arrangements of the parts 46, 48 and 86. In both these arrangements, unit 86 is fully retracted so that indicator element 66 is now at the rear of unit 38. Again, arm 46 is fixed parallel to the belt direction 128 and arm 48 can adopt two dispositions (indicated in full lines and dotted lines respectively) corresponding respectively to the '180' and '0' orientations of the sensed package.

Examination of Fig. 7 will show that, in the illustrated embodiment, the control system must make two decisions in the course of each orientation sensing operation, namely A) whether the end of arm 48 carrying element 66 is closer to or further away from arm 46 (that is, whether element 66 is close to or spaced from the proximity sensor 64) and B) whether element 66 is at the 'front'(Fig. 7a) or at the 'rear' (Fig. 7b) of the unit 38, that is whether unit 86 is extended or retracted.

A suitable sensor (not shown) is associated with unit 86 in order to provide an output signal to the control system upon the basis of which the latter decision can be made.

Consider now route 124 in Fig. 6; this route calls for the '0' orientation (130, Fig. 7). The first decision (represented by block 134) is whether unit 38 is 'facing front' (unit 86 extended -condition FF, Fig 7a) or 'facing rear' (unit 86 retracted - condition FR, Fig. 7b).

If the control system finds that unit 38 is facing front, then it proceeds to the decision represented by block 136, namely whether the sensed package is 'aligned' with unit 38 (element 66 spaced from proximity sensor 64 - condition A in Figs. 7a and 7b) or 'reversed' relative to unit 38 (element 66 adjacent proximity sensor 64 - condition R in Figs. 7a and 7b). It will be realized that each of the expressions 'facing front', 'facing rear', 'aligned' and 'reversed' is purely arbitrary and has been selected merely for purposes of identification of different possible conditions in this description. If decision 136 is that the package is aligned with unit 38, than a signal representing this "positive" outcome is stored, this operation being indicated by block 138 in Fig. 6.

If decision 134 is that unit 38 is facing rear, or if decision 136 is that the package is reversed relative to unit 38, then the control system proceeds immediately to the decision represented by block 140, to which it also proceeds after the storage operation represented by block 138. Block 140 represents a second decision as to whether unit 38 is facing front or facing rear. If unit 38 is facing rear, the control system proceeds to block 142 where a decision is made whether the sensed package is aligned or reversed relative to unit 38. If the package is reversed, a signal representing this "positive" outcome is stored as indicated at block 144. If decision 140 is that unit 38 is facing front, or decision 142 is that the package is aligned relative to unit 38, then the control system proceeds immediately to the decision represented by block 146, to which it also proceeds after the storage operation indicated in block 144.

In the operation represented by block 146, the control system examines the results of decisions 136 und 142, that is the control system examines the conditions of the stores representing the outcomes of those decisions. A comparison of Fig. 6 with Fig. 7 will show that a "positive" outcome to

either of decisions 136 and 142 means that the sensed package is in the desired orientation.Accordingly, if the control system finds the appropriate stored signal during operation 146 than it proceeds to the operations represented respectively by blocks 148 and 150, namely opening of the arms 46, 48 to release the package (block 148) and restarting of belt 22 in order to move the correctly oriented package out of the sensing zone (150).

If operation 146 indicates a negative outcome to both of decisions 136 and 142, then the control system proceeds to a series of operations represented as a group by block 152. These operations include lifting of the unit 38 in order to move the sensed package clear of belt 22, sensing of the current condition of unit 86 and reversal of that condition, and lowering of unit 38 in order to return the oriented package to belt 22. After completion of the operation group 152, the control system proceeds to operations 148 and 150 already described.

In view of the detailed description of route 124, it is believed that route 126 will be readily understood with a relatively brief description of the blocks shown therein. Blocks 154 and 160 represent decisions whether unit 38 is facing front or facing rear. Blocks 156 and 162 represent decisions whether the package is aligned or reversed relative to unit 38. Block 158 represents storage of a "positive" outcome of decision 156 and block 164 represents storage of a "positive" outcome of decision 162. Block 166 represents a search for a "positive" outcome to either of decisions 156 and 162. The control proceeds from decision 154 to decision 156 if unit 38 is found to be facing rear, and from decision 160 to decision 162 if unit 38 is found to be facing front. The outcome of decision 156 is "positive" if the sensed package is found to be aligned with unit 38 and the outcome of decision 162 is "positive" of the package is reversed relative to the unit.

Carriage Moving System

The control system switches between routes 124 and 126 in dependence upon signals its receives representing the current condition of a carriage moving system which will be briefly described with reference to Fig. 1. Attached to end unit 10 at ground level is a horizontally elongate housing 168 disposed at right angles to the length of the machine and the direction of movement of belts 14, 22. An arm 170 projects from housing 168 and is mounted on a bar 172 extending longitudinally of the housing underneath the bridge structure. At its opposite end (hidden in Fig. 1 by the pier 32) bar 172 carries a second arm projecting therefrom in the same manner as arm 170. Bar 172 is rotatable about its own longitudinal axis so to move the arms between an upright position illustrated in Fig. 1 and a lowered position in which the arms extend substantially in the direction of movement of belts 14 and 22. In their upright positions, the arms do not interfere with movement of a package receiving carriage into the space between housing 168 and pier 32. When the carriage has been suitably located relative to the bridge structure by a machine attendant, bar 172 can be rotated to bring the arms into their lowered positions in which they engage respective opposite ends of the carriage. Bar 172 can now be controllably reciprocated by a suitable driving means (not shown) longitudinally of the housing 168, thereby moving the carriage in a controlled fashion in directions transverse to the direction of movement of the belts.

The drive for reciprocated bar 172 is preferably settable so that the bar (and a carriage) can be caused to move along the housing in a series of equal steps. The length of each step is dependent upon the maximum diameter of the packages to be layed in the carriage. The number of steps which together make up a full stroke of the bar 172 in any given direction will be dependent upon the number of parallel rows of packages which are to be layed in the carriage to make up single layer therin. Each row is of course deposited in the carriage with the package axes extending parallel to the machine and belt direction, and the carriage is moved through one step after deposition of each row of a given layer in order to prepare it to receive the next row of the same layer. The arrangement is preferably set up so that deposition of packages starts at one end of the carriage and proceeds, with stepping of the carriage until one complete layer has been deposited. A counter (not shown) is provided to register the number of steps through which the carriage is moved. Throughout this stage (deposition of the first layer) the control system selects either route 124 or route 126, without changing its original selection. For convenience, assume that route 124 is first selected, so that all packages of the first layer are deposited in the '0' orientation.

When the counter indicates completion of deposition of the first layer, the control system switches (in the assumed example) from route 124 to route 126 so that the packages of the second layer will be deposited in the '180' orientation. The carriage is caused to move a half step in reverse before the first row of the second layer is deposited, Thereafter the carriage steps in reverse until the second layer has been deposited with one less package than in the first layer. The system reversal

is then repeated for deposition of the third layer, and so on until the carriage is full. A proximity sensor (not shown) can be provided in conjunction with one or more of the grabs 24, and this sensor can be linked to the control system for moving the frame 26, so that lowering of the frame is stopped with the packages for deposition spaced only slightly above the surface upon which they are be deposited (either the floor of the carriage or the packages of the layer below them). Numeral 174 in Fig.1 indicates represents an additional light barrier sensor sending a beam across the carriage way between pier 32 and column 30, so that deposition operations cannot be carried out in the absence of a carriage in the carriage way breaking the light barrier beam.

Modification

The invention is not limited to details of the illustrated embodiment. The sensing/orienting unit 38 could be associated with the end portion of the main transport belt 14 instead of the infeed portion of the auxiliary belt 22. In this case, the main transport belt may have to be stopped briefly in order to enable the sensing/orienting unit to grasp a package. However, this would not represent serious interference in the overall operation of the machine if, e.g., the main transport belt is stopped in any event during a doffing operation at one of the machine processing stations. Furthermore, the sensing/orienting unit could be associated with an intermediate conveyor between the main conveyor and the accumulator conveyor. In this case, it would be possible to operate the accumulator conveyor in the manner claimed in EP-A-0099959, so as to avoied rubbing between the accumulator conveyor and the outer windings of the packages supported theron.

The conveyors do not have to be in the form of belts or bands. The auxialiary conveyor in particular could be made up of a plurality of parallel rollers, selected rollers being drivable into rotation about their own longitudinal axes to cause movement of a package along the conveyor. Drivable rollers could, e.g., be provided in the 'sensing zone' referred to above, and also at the infeed to the 'accumulator zone'. While the rollers in the main part of the accumulator zone should be mounted for rotation around their longitudinal axis, they would not have to be externally driven.

The exact sequence of operations carried out by the unit 38 can be altered to fit desired operating circumstances; for example, the unit could be turned back to 'face front' after each package orienting operation; in this case, the control sequence described with reference to Fig. 6 could be simplified by eliminating the decision regarding the current orientation of unit 38.

However, the control system will then have to be modified to ensure that a new package is not fed into the sensing zone until the return movement of the unit 38 has been completed.

The invention is not limited to use with any particular removal and/or deposition system. For example only, the frame 26 carrying grabs 24 could be movable horizontally to a position above belt 22, and the grabs could then simply be lowered in order to grasp a group of packages accumulated on the belt. Such an arrangement would, however, take up more space above belt 22.

If required, one package engaging arm of unit 38 could be fixed and the other movable towards and away from it to close the package gripper. Either arm could carry the portion which adapts to the package conicity. The arm suspension can be similar to the suspension of the legs as shown in Fig. 9a, that is with both arms pivotable on a common axis. Alternatively the package engaging members could be linearly movable to open and close the gripper.

The control means is preferably a programmable controller, but any control system adapted to carry out the described sequence of operations can be used.

The sensor means responding to the position of part 60 is not necessarily a proximity sensor. Any other sensor (preferably contactless) suitable for detecting presence of a mechanical part in a given disposition could be substituted. A proximity sensor is preferably magnetic, but could for example be pneumatic or electrostatic.

In the removal system, the legs of each grab could be pivotable about respective pivot axes instead of about a common axis. With additonal complication in the control system for controlling movements of the legs, the movement of leg 102 into the space between package 112 and belt 22 could be effected by controlled pivoting of leg 102 by means of a power drive therefor, eliminating the mechanical engagement with plate 113. Where the latter is provided, the grab holding the full package must be able to pass by the outer edge of the plate as the grab moves down into the carriage.

Claims

1. A system for handling thread packages with an oriented configuration, especially conical thread packages (16), comprising a main conveyor (14) and at least one auxiliary conveyor (22) forming an extension of the main conveyor, characterized in comprising further means (38) at the junction of the main and auxiliary conveyor to sense the orienta-

tion of a thread package (16) on the conveyor and to reverse that orientation if required to ensure that each thread package (16) of a row of packages formed on the auxiliary conveyor (22) has a set orientation. (Fig. 1)

2. A system as claimed in claim 1 characterized in further comprising control means (88, 90, 92, 94) to control said sensing and orienting means (38) to ensure that all thread packages (16) of the row have the same orientation. (Fig. 1)

3. A system as claimed in any preceding claim wherein said sensing and orienting means (38) is located so as to sense orientation of a thread package (16) after the latter has been transferred from the main conveyor (14) to the auxiliary conveyor (22). (Fig. 1)

4. A system as claimed in any preceding claim comprising control means (88, 90, 92, 94) selectively operable to change the set orientation. (Fig. 1)

5. A system as claimed in any preceding claim further comprising removal means (24) to remove a group of thread packages (16) simultaneously from said auxiliary conveyor (22). (Fig. 1)

6. A system as claimed in any preceding claim and further comprising moving means (172) for controllably moving a thread package receiver relative to said auxiliary conveyor (22). (Fig. 1)

7. A system as claimed in claims 4 and 6 wherein said removal means (172) is operable to deposit thread packages (16) in a receiver movable by said moving means so as to form layers of thread packages (16) in a receiver controlled by said moving means (172) and said control means (88, 90, 92, 94) is operable to reverse the set orientation after one full layer has been deposited. (Fig. 1)

8. Apparatus for orienting thread packages with an oriented configuration, especially conical thread packages (16; 54) on a package conveyor (14) comprising a pair of package engaging members (46, 48), characterized in that at least one (48) of the engaging members has a portion (60) arranged to adopt respective dispositions depending upon the orientation of an engaged thread package (16) relative to the conveyor (14), further comprising means (64) to sense the disposition of said portion and means (86) selectively operateable to move said package engaging members (46, 48) to reverse the orientation of a thread package (16; 54) grasped thereby. (Fig. 1,3)

9. Apparatus as claimed in claim 8 wherein said selectively operable means (86) is operable to rotate said package engaging members (46, 48) simultaneously about an axis transverse to the longitudinal axis of a grasped thread package (16; 54). (Fig. 1, 3)

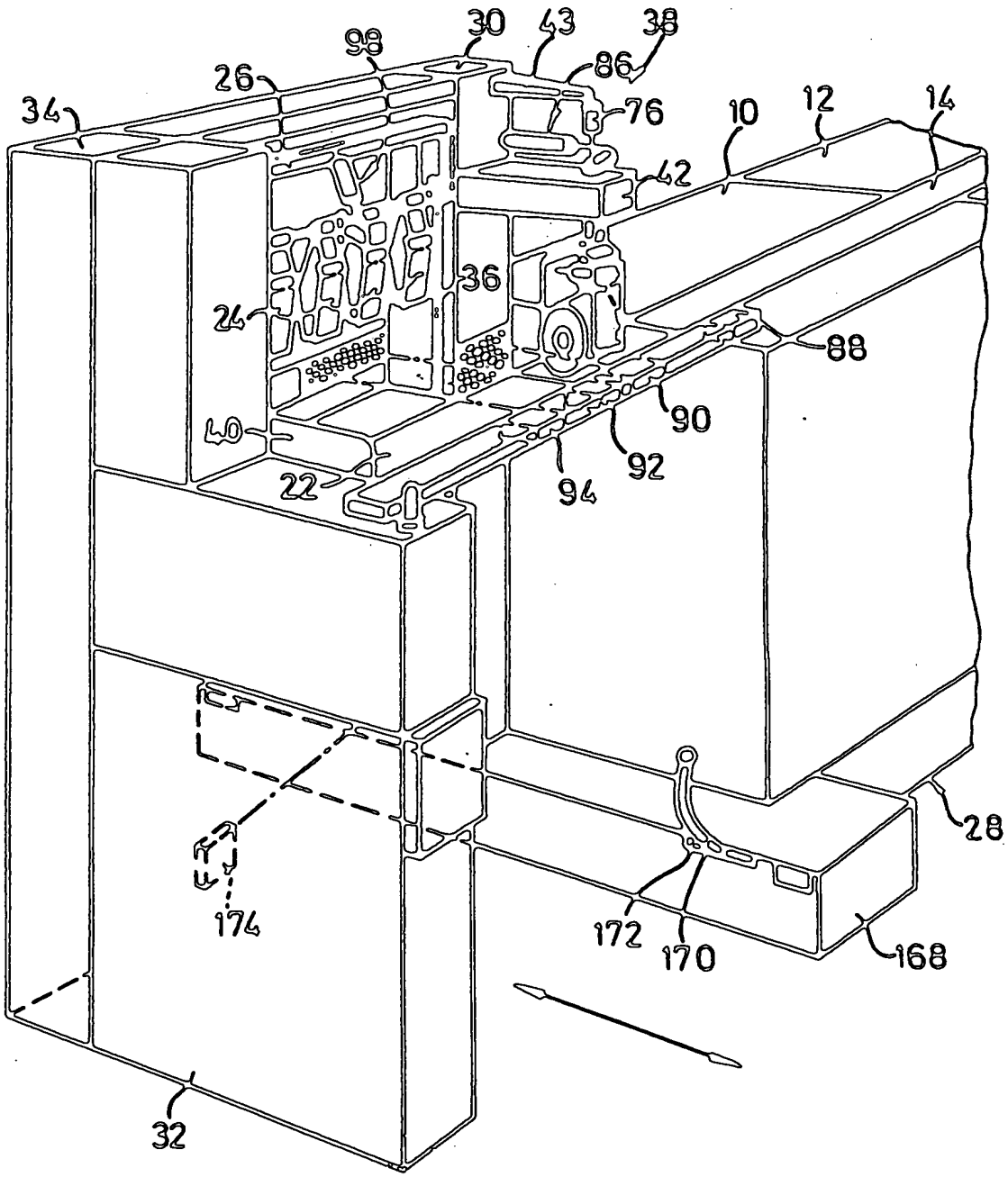
10. Apparatus as claimed in claim 8 or claim 9 including mounting means (44) mounting said package engaging members (46, 48) for relative movement of approach and separation, said portion being pivotable about, an axis transverse to said movement of approach and separation. (Fig. 3)

11. Apparatus as claimed in any one of claims 8 to 10 wherein said sensor means comprises a proximity sensor (64) adapted to respond to the presence of the portion in one of its said dispositions. (Fig. 3)

12. A device for removing a thread package with an oriented configuration, especially conical thread packages (16), from a package support, especially from a conveyor (22) of a handling system, characterized in comprising further a carrier (26) and openable and closable package gripping members (24) being pivotably secured on the carrier, the carrier (26) being movable along a path to one side of the support or conveyor (22), and pivoting means (98, 100, 101) for pivoting the gripping members (24) to cause one member (102) to engage between the under side of the thread package (112) and the support or conveyor (22), whereas the other gripping member (104) engaging the upper side of the thread package (112). (Fig. 1,9)

13. A device as claimed in claim 12 wherein said pivoting means (98, 100, 101) includes an abutment member (103) adapted to engage the gripping member (102) between the under side of the tread package (112) and the support or conveyor (22). (Fig. 9)

Fig.1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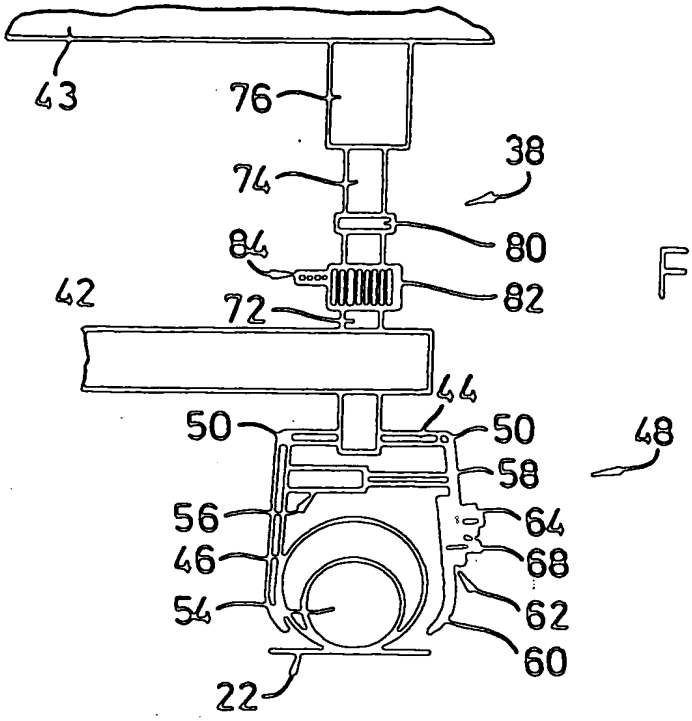
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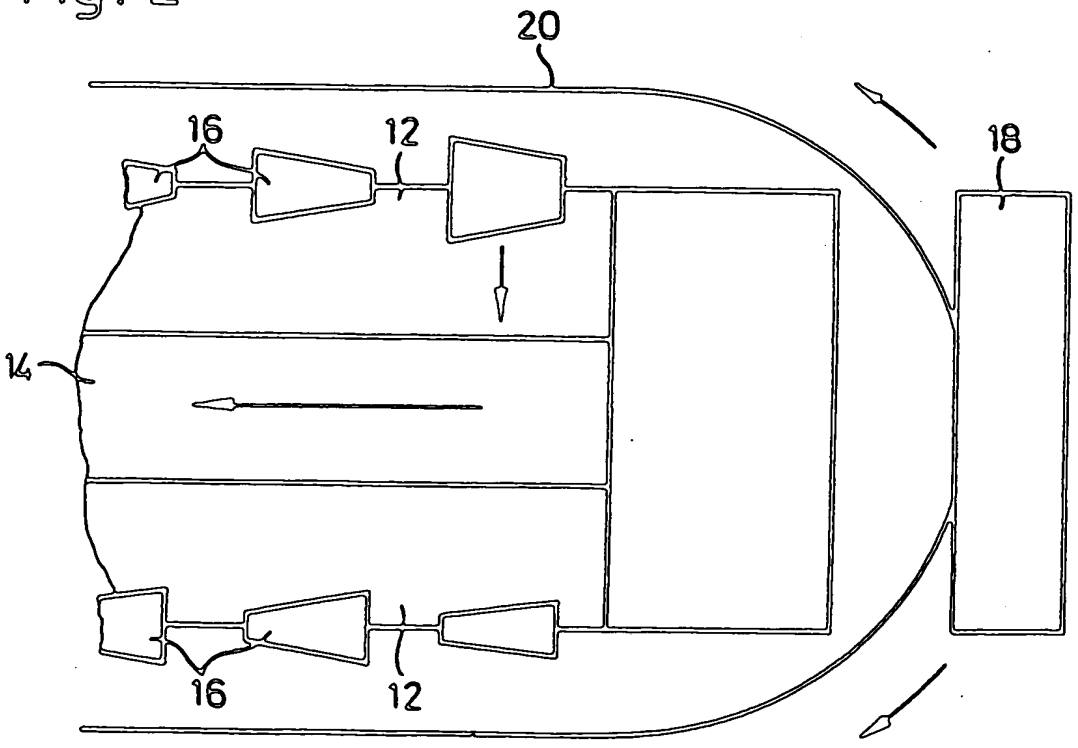
Fig. 3

Fig. 2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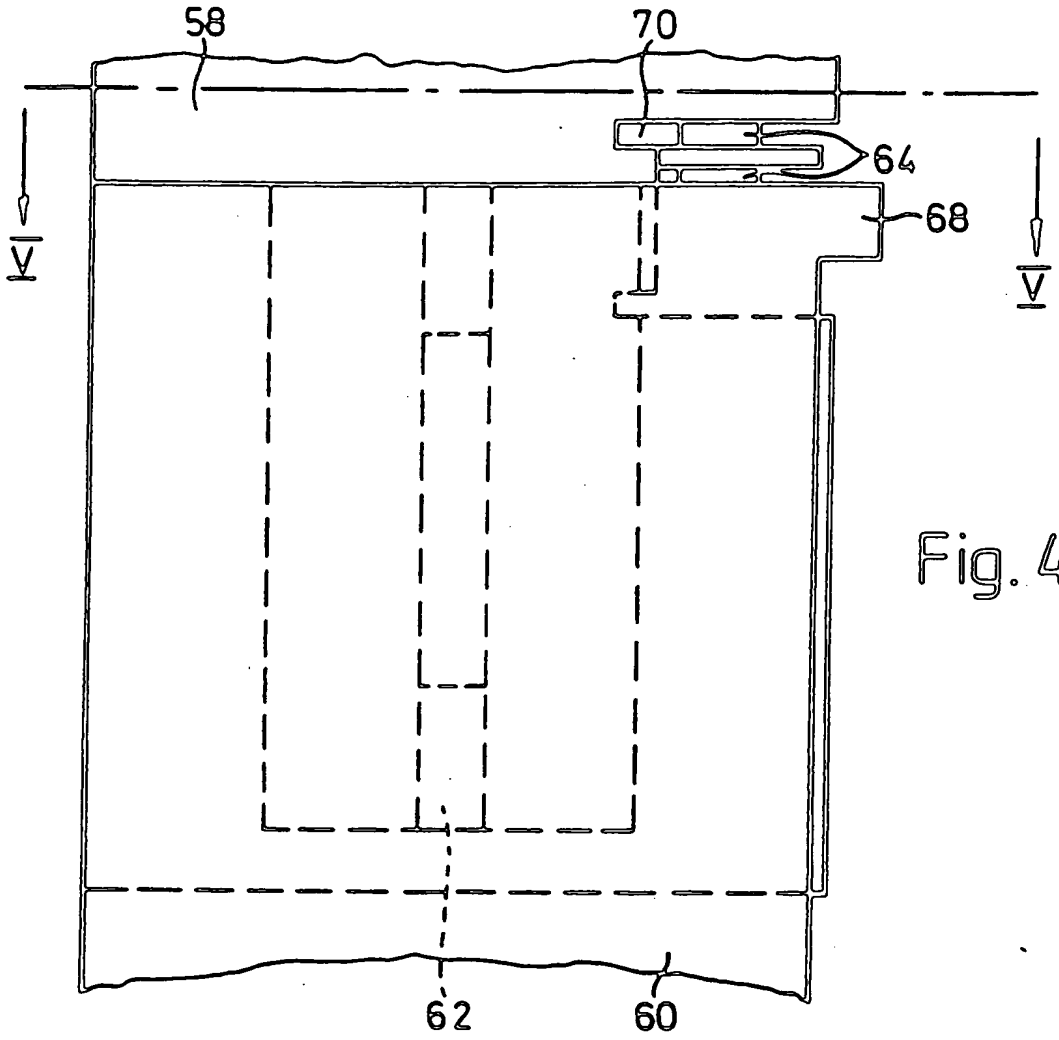

Fig. 4

Fig. 5

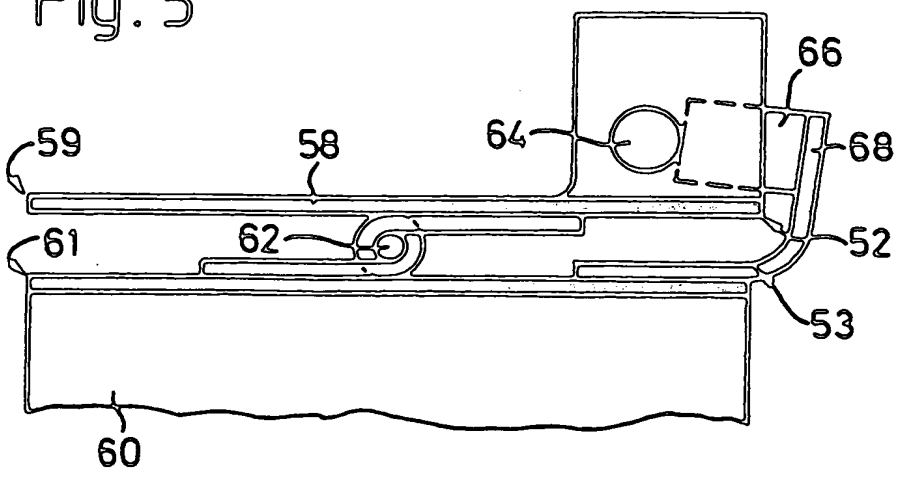

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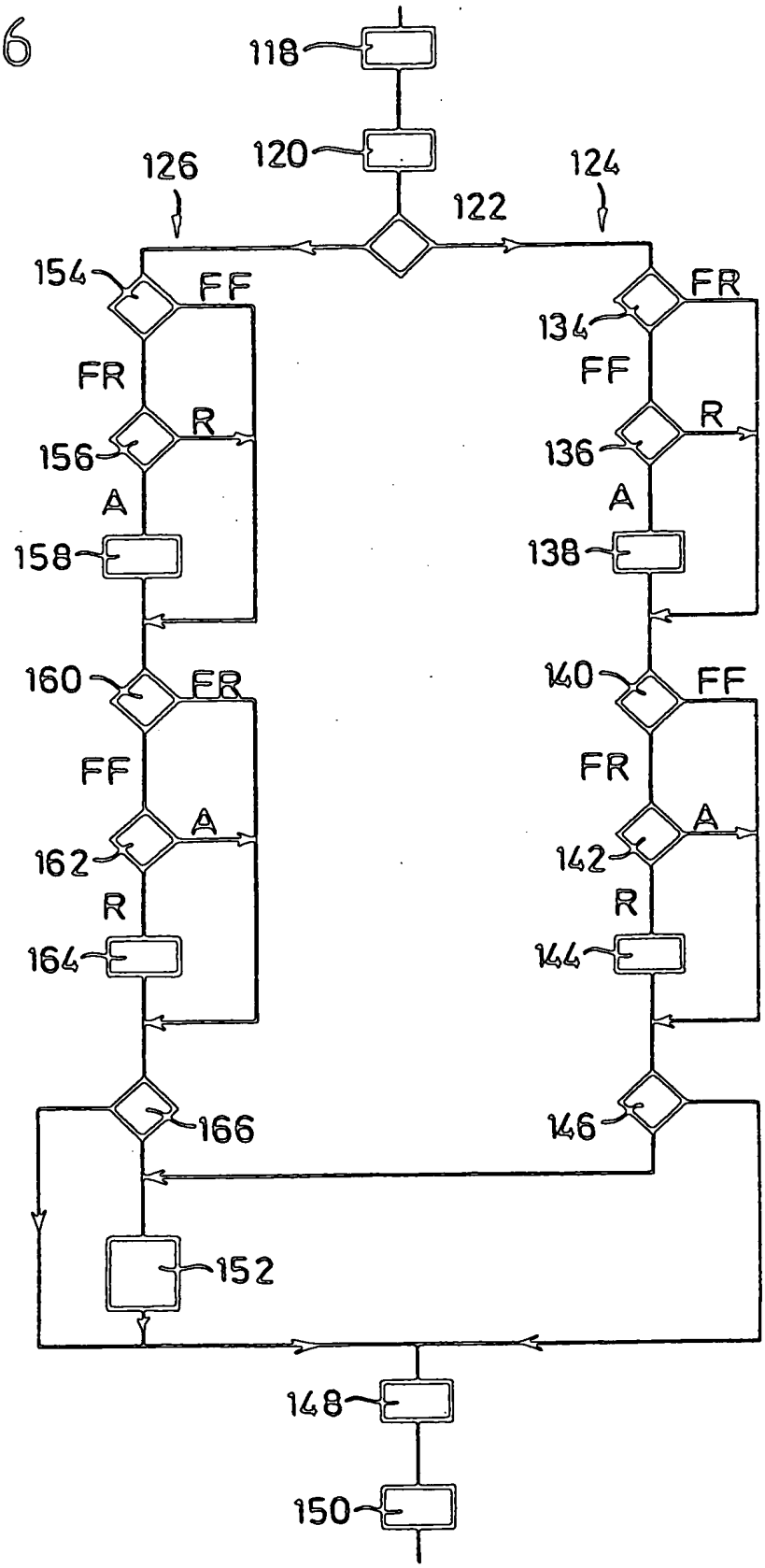
Fig. 6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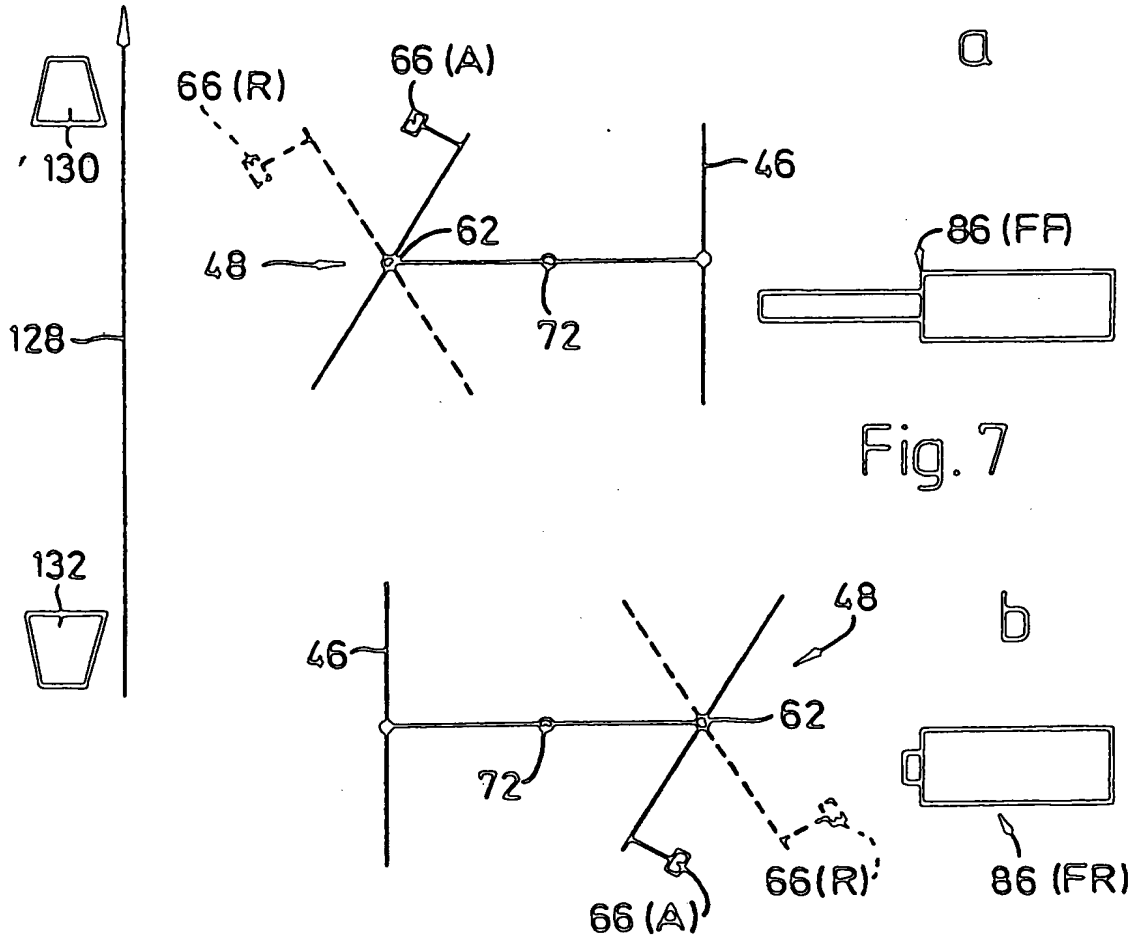
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66 (A)
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86 (FR)

Fig. 7

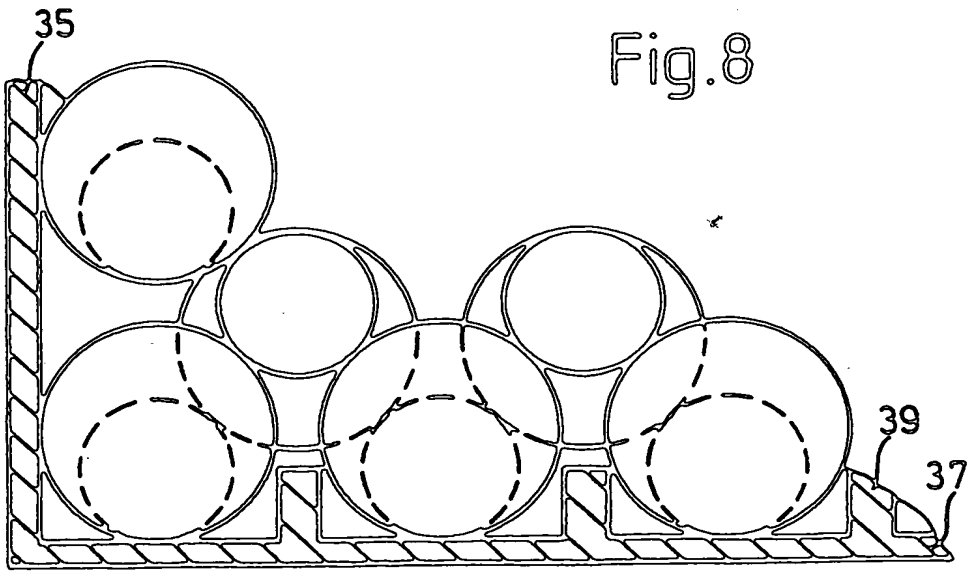
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Fig. 8

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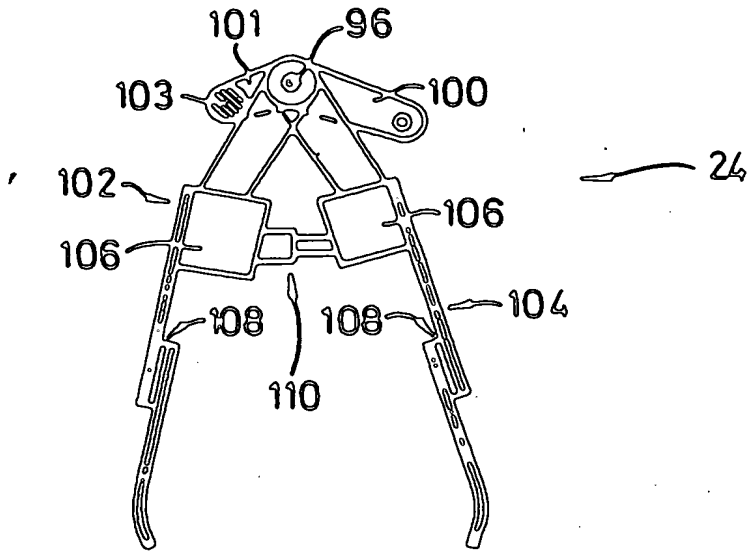
Fig.9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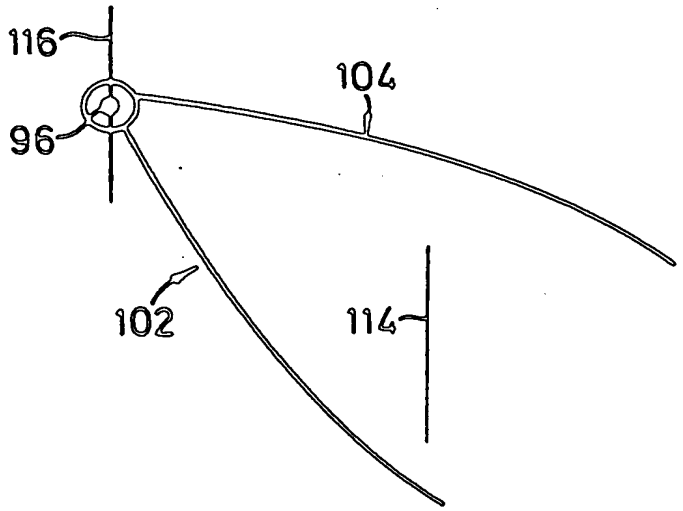
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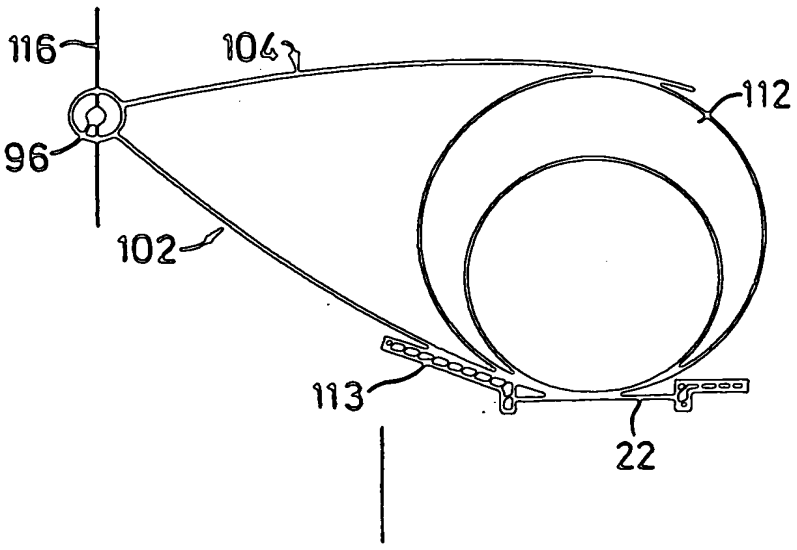
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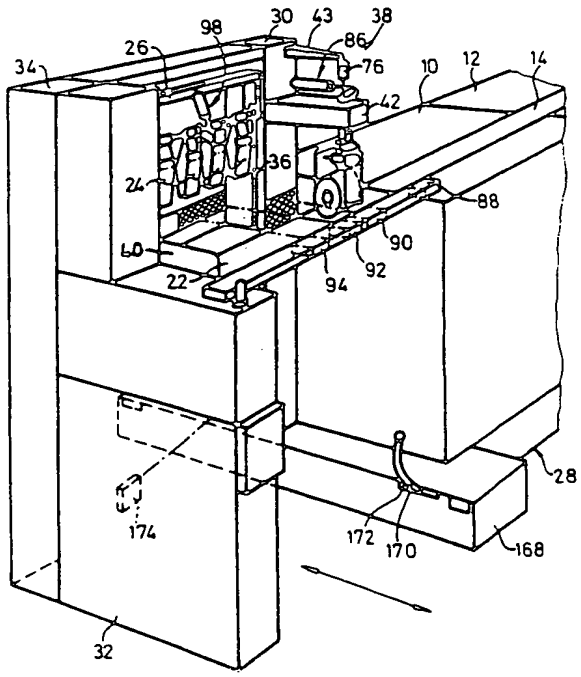
(54) Handling of thread packages with an oriented configuration.

(57) In a handling system for handling conical thread packages delivered on a conveyor (14), a device (38) is provided to sense the orientation of each package, to compare it with a desired orientation, and to reorient the package if required before relasing the package to a further conveyor (22) on which groups of oriented packages are formed.

Fig.1



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EUROPEAN SEARCH REPORT

Application Number

EP 90 11 7824

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	PATENT ABSTRACTS OF JAPAN, vol. 7, no. 257 (M-258)[1402], 16th November 1983; & JP-A-58 139 979 (TOYODA JIDO SHOKKI SEISAKUSHO K.K.) 19-08-1983 * Whole document *	1,2	B 65 H 67/06
A	IDEM	5,8,9,11	
X	JP-A-5 819 732 (TOYODA JIDO SHOKKI SEISAKUSHO K.K.) * Figures * & US-A-4 565 278 (ASAI et al.) 21-01-1986	1,2,3	
D,P,A	EP-A-0 099 959 (MASCHINENFABRIK RIETER AG) * Page 5, lines 14-31 *	1,5-7,12	
X	FR-A-2 510 083 (MOSS SRL.) * Page 1; page 8, lines 4-9; figures *	1,2	
A		12	
E	EP-A-0 113 125 (OFFICINE MINNETTI) * Whole document *	1-4,8-11	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
D,A	FR-A-2 250 699 (ATELIERS DE CONSTRUCTION SCHWEITER S.A.) * Whole document *	8-10	B 65 H B 65 G
A	PATENT ABSTRACTS OF JAPAN, vol. 7, no. 163 (M-229)[1308], 16th July 1983; & JP-A-58 69 615 (MURAO BOUKI K.K.) 25-04-1983 & US-A-4 474 525 (MURAO) 02-10-1984	1,5,12	

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The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	19 April 91	D HULSTER E.W.F.

CATEGORY OF CITED DOCUMENTS

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Application Number

EP 90 11 7824

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-2 031 367 (SCHUBERT & SALZER MASCHINEN-FABRIK AG) * Figures *	6	
D,A	US-A-3 853 215 (PAIVA) * Figure 4; claims *	12,13	
A	US-A-3 513 959 (G. FREHN)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	19 April 91	D HULSTER E.W.F.

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